

CLAIMS

1. An indirectly heated cathode ion source comprising:

an arc chamber housing defining an arc chamber having an extraction aperture;

an extraction electrode positioned outside of the arc chamber in front of the

5 extraction aperture;

an indirectly heated cathode positioned within the arc chamber;

a filament for heating the cathode;

a filament power supply for providing current for heating the filament;

a bias power supply coupled between the filament and the cathode;

10 an arc power supply coupled between the cathode and the arc chamber housing;

an extraction power supply, coupled between the arc chamber housing and the  
extraction electrode, for extracting from the arc chamber an ion beam having a beam  
current;

15 an ion source controller for controlling the beam current extracted from the arc  
chamber at or near a reference extraction current.

2. An ion source as defined in claim 1 wherein said ion source controller  
comprises feedback means for controlling the extracted beam current in response to an  
error value based on the difference between a sensed beam current and the reference  
20 extraction current.

3. An ion source as defined in claim 2 wherein said feedback means comprises  
means for controlling a bias current supplied by said bias power supply in response to the  
error value.

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4. An ion source as defined in claim 2 wherein said feedback means comprises  
means for controlling a filament current supplied by said filament power supply in  
response to the error value.

5. An ion source as defined in claim 2 further comprising an extraction current sensor for sensing an extraction power supply current that is representative of the extracted beam current.

5 6. An ion source as defined in claim 2 wherein said feedback means comprises a Proportional-Integral-Derivative controller.

7. An ion source as defined in claim 1 further comprising:  
a suppression electrode positioned between the arc chamber housing and the  
10 extraction electrode; and  
a suppression power supply coupled between the suppression electrode and ground.

8. A method for controlling an indirectly heated cathode ion source comprising a  
15 cathode and a filament for heating the cathode, said method comprising the steps of:  
sensing a beam current extracted from the ion source; and  
controlling a bias current between the filament and the cathode in response to an error value based on the difference between the sensed beam current and a reference extraction current.

20 9. The method as defined claim 8 further comprising steps of:  
maintaining a filament current at a constant value; and  
maintaining an arc voltage at a constant value;  
wherein a filament voltage and an arc current are unregulated.

25 10. A method for controlling an indirectly heated cathode ion source comprising a cathode and a filament for heating the cathode, said method comprising the steps of:  
sensing a beam current extracted from the ion source; and  
controlling a filament current through the filament in response to an error value  
30 based on the difference between the sensed beam current and a reference extraction current.

11. The method as defined claim 10 further comprising steps of:  
maintaining a bias current at a constant value; and  
maintaining an arc voltage at a constant value;  
wherein a bias voltage and an arc current are unregulated.

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12. A method for controlling an indirectly heated cathode ion source comprising  
a cathode and a filament for heating the cathode, said method comprising the steps of:  
sensing a beam current extracted from the ion source; and  
controlling the beam current extracted from the ion source in response to an error  
10 value based on the difference between the sensed beam current and a reference extraction  
current.

13. A method for controlling a beam current extracted from an arc chamber  
comprising steps of:

15 providing an arc chamber housing defining an arc chamber having an extraction  
aperture;  
providing an extraction electrode positioned outside of the arc chamber in front of  
the extraction aperture;  
providing an indirectly heated cathode positioned within the arc chamber;  
20 providing a filament for heating the cathode;  
providing a filament power supply for providing current for heating the filament;  
providing a bias power supply coupled between the filament and the cathode;  
providing an arc power supply coupled between the cathode and the arc chamber  
housing;  
25 providing an extraction power supply, coupled between the arc chamber housing  
and the extraction electrode, for extracting from the arc chamber an ion beam having a  
beam current;  
providing an ion source controller for controlling the beam current extracted from  
the arc chamber at or near a desired level, in response to an extraction current supplied by  
30 the extraction power supply.